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# MEDICAL NEWS LETTER

Rear Admiral Bartholomew W. Hogan MC USN - Surgeon General
Captain Leslie B. Marshall MC USN (RET) - Editor

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## TABLE OF CONTENTS

## Policy

The U. S. Navy Medical News Letter, is basically an official Medical Department publication inviting the attention of officers of the Medical Department of the Regular Navy and Naval Reserve to timely up-to-date items of official and professional interest relative to medicine, dentistry, and allied sciences. The amount of information used is only that necessary to inform adequately officers of the Medical Department of the existence and source of such information. The items used are neither intended to be, nor are they, susceptible to use by any officer as a substitute for any item or article in its original form. All readers of the News Letter are urged to obtain the original of those items of particular interest to the individual.

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## Poison Ivy Dermatitis

The family, Anacardiaceae, includes many widely distributed species which are both noxious and useful. The baleful species, of which certain members of the genus Rhus have achieved notoriety in the United States, have in common the capacity to induce a severe contact dermatitis. All the dermatitogenic Anarcardiaceae are members of an immunologic cross-reacting group owing to biochemical similarities of their antigens. Sensitization to one carries with it the verdict of allergic reactivity to the rest.

Nature has allowed certain compensations for the following dermatitis-producing Anardiaceae in that each has some agreeable or economically useful property.

1. Rhus verniciflua - the lacquer tree from which Orientals prepare a rich furniture lacquer.
2. Semecarpus anacardium - the India ink tree or marking nut used to stain clothing, often as a laundry mark.
3. Mangifera indica - the mango, a delicious fruit.
4. Anacardium occidentale - the cashew nut; an oil is obtained from the shell which is valuable in resin manufacture; the meat of the nut is a favorite delicacy the world over.

It may be noted that not all species of Rhus are "poisonous." Indeed, some are prized ornamentals. This hardly neutralizes the fact that Rhus species are by far the Number One cause of allergic contact dermatitis in the United States, the sufferers from which exceed in number the total of all other forms of allergic disease combined.

One of these species, Rhus vernix, poison sumac or poison dogwood, has a limited distribution. It is a rather uncommon coarse shrub or tree

found only in woody swampy areas. It has an evil reputation, being commonly thought to be the most poisonous of the group. Most persons have never seen it and its importance as a plant nuisance is negligible.

The two plants which are the chief source of Rhus dermatitis in the United States are poison ivy and poison oak. The proper classification has long been a bone of contention among botanists. The taxonomic confusion stems from the morphologic variability of the plants. That they are closely related cannot be doubted. The botanical argument relates to whether they are separate species or merely varieties. Poison ivy in particular—as if to emphasize its treacherous nature—appears in various guises, as a trailing recumbent plant, as an erect low bush or leaning shrub, or as a woody vine.

Poison ivy is a single variable species, Rhus radicans, which contains several taxonomic varieties and forms. It is widely distributed in many different situations, particularly throughout the northeastern United States and Canada. It may be separated from Rhus toxicodendron, poison oak, on morphologic grounds, by distribution, and by habitat. Poison oak is a Pacific Coast species occurring in dry barrens, pinelands, and sands of Mexico, California, Oregon, Washington, and British Columbia. A fairly safe assumption is that the related plant which occurs everywhere else in the United States is the more versatile poison ivy. Distinguishing morphologic features are: (1) It never occurs as a climbing vine or trailer; (2) The leaf stems (petioles) are hairy; (3) Both the upper and lower surfaces of the leaf are hairy or tomentose, while in poison ivy the undersurface may be hairy or smooth with the upper surface generally smooth. The leaf shape is variable in both species, but that of poison oak more consistently suggests an oak leaf. Rhus species occur in every state of the Union.

As a rule, laymen and physicians are not aware of these taxonomic refinements and use the terms poison ivy dermatitis and poison oak dermatitis interchangeably. Needless to say, the eruptions are identical and the belief of some that the offending plant can be judged from the disease is groundless. Californians often argue that poison oak is a more virulent species than its eastern relative.

So important is Rhus dermatitis in the United States that it is too easy to forget that many other species of unrelated plants may cause allergic contact sensitivity. None of these diverse plants can match Rhus species in allergenic potency with the consequence that only occasional persons having a special predisposition and probably intensive contact ever become sensitized. Still, recognition of this problem is important because many persons are encountered who have received prophylactic injections against Rhus dermatitis when, in fact, other plants were at fault.

When the poison ivy plant is cut, a milky sap exudes which shortly turns into a black varnish. This discoloration is the biochemical basis for the economic use of the marking nut tree (laundry mark) and Japanese lacquer.

It is a common property of many phenolic compounds including the formation of melanin from dihydroxyphenylalanine.

The peak incidence of poison ivy dermatitis in the springtime cannot be ascribed to increased virulence of the sap. Factors of probable significance are that (1) being more tender, the leaves are more readily bruised; in late summer, especially in hot sunny locations, the leaves are quite tough and leathery; (2) the call of the outdoors is never so strong as in the spring; for many, this is the only time of year when the urge to commune is irresistable; (3) the strongly sensitive become more wary as the summer progresses; (4) the possibility of desensitization or "hardening" with repeated attacks may be mentioned, but is probably remote under ordinary circumstances.

Many persons insist that they can acquire poison ivy dermatitis by merely being in the vicinity of the plants and some, indeed, do so without even being near them. That there are gaseous emanations is folk myth; the antigenic components are nonvolatile. Filtered smoke is harmless, but not if it contains plant particles. However, direct contact with the plant is not a prerequisite for the dermatitis. Failure to appreciate the possibility of transmitting the dermatitogenic sap via many intermediate fomites, such as fingers, shoes, clothing, tools, domestic animals, et cetera, has generated numerous myths and misunderstandings.

The allergenic principle is present in all parts of the plant which contain resin canals. Its release requires bruising of the tissue. The factors which influence the dermatitogenecity of the plants are detailed.

All persons can become Rhus-sensitive with sufficient exposure at the appropriate time. There is no evidence of a spontaneously acquired immunity. There is no racial immunity. About 50% of young adults will react positively to the application of bruised leaves. Darkly pigmented races have a lower incidence. Sensitivity gradually declines with time regardless of continued casual exposure. A minority of persons over 60 are Rhus-sensitive.

Those who react to strong concentrations of the saturated Rhus allergen (pentadecyl catechol), but not to the leaf are termed subclinical reactors. Presumably, most of these have lost their clinical sensitivity. Once lost, sensitivity is not easily reestablished except by severe exposure and then only in a minority of instances.

Rhus sensitization cannot be prevented by prior feeding or contact with the allergen. The depth or degree of sensitization is revealed by quantitative patch tests with serial dilutions. The titer, beyond which further dilution causes no reaction is a meaningful measure of the degree of sensitization.

The theoretical proposition is made that allergic contact dermatitis is a generalized state of sensitivity with chief reactivity localized in the skin. Immediately after, or concomitant with, severe widespread Rhus dermatitis the skin may show two opposite types of reaction: supersensitivity or

hyposensitivity. The unusual consequences of Rhus dermatitis include eosinophilia, kidney damage, urticaria, and dyshidrosis.

There is no practical topical measure which will adequately protect against field exposures to Rhus plants. This includes soap and water washing, barrier creams, and detoxicants. No topical therapy is efficacious in aborting or moderating Rhus dermatitis as compared with the usual nonspecific dermatologic measures.

Corticosteroids are the only systemic agents with a demonstrated ability to benefit Rhus dermatitis. Treatment by the administration of Rhus allergens during the acute attack is irrational and hazardous. (Kligman, A. M., Poison Ivy (Rhus) Dermatitis - An Experimental Study: Arch. Dermat., 77: 149-177, February 1958)

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## Embolism During Heparin Therapy

Heparin is a widely used and valuable agent in the management of many thrombotic disorders involving both the arterial and the venous systems. Although this is the oldest of the modern anticoagulant drugs, its mode of action and specific effect on the clotting mechanism in vivo have not yet been clearly defined. It is, however, a potent and effective agent and possesses certain distinct advantages over the coumarin drugs when used in combination with surgical treatment. Its rapid action and prompt neutralization by protamine are desirable qualities in many circumstances.

Except for the rare instances of allergic reactions, complications or adverse effects reported from the use of heparin have been due to hemorrhage. Recently, heparin has been used more frequently as the anticogulant of choice in the treatment of acute thromboembolic disorders or in conjunction with direct surgery on the arteries and veins. There has been a coincident alarming increase in the occurrence of peripheral arterial embolism during the course of active heparin therapy. This observation has prompted review of these cases in an attempt to determine the role of heparin in this complication.

In the authors' experience and in most reported series of peripheral arterial emboli, the heart has been considered the probable source in about 90% of cases. The proximal arterial system, i.e., aorta or major vessels, has been considered a relatively infrequent source of recognizable embolic occurrences. However, it is common to observe friable fibrin-and-platelet thrombi adherent to the wall of an atherosclerotic aorta at autopsy. The significance of this finding has apparently never been thoroughly studied. It is known that thrombi made up mostly of platelets and fibrin are the variety usually seen in the presence of a high velocity of blood flow. These thrombi differ strikingly from those seen where eddying or low-velocity flow is present. The latter tend to contain all cellular elements of the blood in approximately normal proportions.

Ten such cases have been observed in approximately three years. The clinical picture, the gross appearance of the emboli, and the autopsy findings—when obtained—clearly suggest a direct relationship to heparin effect on preexisting unsuspected mural aortic fibrin-platelet thrombi. The complication occurred during convalescence from less serious thrombotic disorders as well as after surgical treatment of arterial lesions in which heparin was being used as an important adjunct of postoperative management. The emboli seriously affected the final result and proved fatal in six cases.

In each of the present cases, the sudden occurrence of major arterial occlusion typical of arterial embolization—often without preexisting signs of arterial disease—has been a serious problem. In nearly all instances, there were multiple emboli and heroic measures were undertaken to correct the acute arterial insufficiency.

In at least three cases the authors suspect that embolization had occurred from the aorta prior to admission and the management of the problem was directed at the peripheral manifestation because of absence of clinical or laboratory signs of the underlying problem of aortic mural thrombi.

An increasing awareness of this most obscure problem may help in establishing a diagnosis or a suspicion of the existence of nonobstructing, friable, loosely adherent mural aortic thrombi. Angiocardiography or aortography via a brachial artery catheter may be a method of establishing a diagnosis.

In each instance, there was a feeling of futility in the management of the problem due to anticipation of further emboli from the same or similar sources. Heparin was badly needed to retard distal thrombosis, yet the agent was probably seriously altering the integrity and attachment of the thrombotic source.

The authors now respect the danger inherent in the use of heparin in these susceptible persons, and feel that if heparin is to be used, it must be in doses less than were previously believed desirable. To establish clotting times more than twice or three times normal is no longer thought to be wise or necessary.

An important side issue which has been raised by study of the present cases is the clinical significance of the gross and microscopic appearance of the embolic material found at embolectomy. As a result of this experience, the authors believe they can differentiate those emboli which arise from mural thrombi in the heart chambers from those which propagate on the intima of the aorta. This information is important to obtain in any specific case so that a more intelligent future management and prognosis of the vascular or cardiac situation can be planned. In the present state of knowledge, it is believed that heparin should be promptly reduced in dosage and, if possible, discontinued if the presence of fibrin-platelet thrombi adherent to the intima of the aorta is suspected.

When serious peripheral emboli occur in patients on heparin therapy, an aggressive attitude in surgical management should be adopted, even though the prognosis for further embolization with loss of one or both lower extremities seems great. In general, these patients have been somewhat better surgical risks than the average patient suffering from peripheral emboli from cardiac sources. There appears to be more to gain than to lose from prompt embolectomy whenever the localization can be established. Embolectomy in the extremities can be done under local anesthesia without adding serious risk to an already precarious situation. Distal thrombectomy should also be carried out when indicated unless irreversible ischemic changes are present. Early ischemic myositis or early localized gangrene of skin of the extremities does not contraindicate aggressive toilet of the major arteries of the lower extremities. In at least two of the present cases, the last embolic occurrence was to the bifurcation of the aorta, and it was suspected that the entire thrombus dislodged and migrated distally where surgical removal was possible. (Weismann, R.E., Tobin, R.W., Arterial Embolism Occurring During Systemic Heparin Therapy: Arch. Surg., 76: 219-225, February 1958)

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## Ascites in Liver Disease

In virtually all patients with ascites as the result of liver disease, multiple mechanisms operate to form this localized edema fluid. The relative importance of each of these factors varies from patient to patient and determines in part the therapeutic strategy most likely to be successful in management.

Factors leading to ascitic retention in liver disease may be divided into two broad groups: (1) those factors operating systemically which lead to a generalized tendency to accumulate edema fluid, and (2) those factors located within the peritoneal cavity which cause abdominal localization of edema fluid. These mechanisms may be classified as follows:

Systemic factors: (1) lowered plasma osmotic pressure—hypoproteinemia, especially hypoalbuminemia; (2) increased plasma antidiuretic substances.

Intraperitoneal factors: (1) portal venous hypertension; (2) low tissue resistance; (3) intrahepatic congestion; (4) increased small vessel permeability.

Ascitic fluid does not represent an isolated "closed" bodily fluid space, but is in rapid equilibrium with circulating plasma and lymph. Investigations with tritium-labeled water have shown very rapid turnover of water components (40 to 80% hourly), and studies with protein infusions have established

rapid equilibration of protein components. Any treatment, therefore, which is planned upon the assumption that a temporary relief of conditions within a closed peritoneal compartment is all that is required, usually fails to give prolonged control.

With conservative care, spontaneous improvement in ascites may progress slowly over many months. Therefore, one should not become discouraged so as to label patients as "intractable" producers of ascites until from 2 to 6 months' observation has been made. Similarly, the more heroic measures of therapeutic attack upon the ascites should ordinarily not be proposed until at least two months' conservative effort has been accomplished.

If nutritional depletion or hypoproteinemia exists, emphasis should be placed upon increased caloric and protein intake. The assimilation of much-needed raw materials in this manner may result in an increase of plasma, total protein, and albumin concentrations by which increasing plasma osmotic pressure would, in turn, reduce the edema problem.

Limitation of sodium intake is generally the cornerstone of therapy in the ascites of liver disease and will usually effectively limit such abnormal fluid accumulation. The degree of sodium restriction is adapted to each patient's needs, varying from a usual reduction to 2 or 3 Gm. daily as sodium chloride to a reduction to 350 mg. daily in the more severe problems. Compromises in desirable degree of sodium limitation are often necessary to insure adequate caloric and protein intake.

Compared to their satisfactory efficacy in congestive heart failure, the results of diuretic agents in hepatic disorders with edema are commonly disappointing. Nevertheless, they are always worth trying because some cases respond well. Combinations of mercurial agents with Rolicton or Diamox are most helpful. Diamox, through its effect upon peripheral ammonia metabolism, may occasionally also cause hepatargy.

As regular therapy to relieve the ascites of liver disease, abdominal tapping should be energetically avoided. Hazards include puncture of collateral veins in the abdominal wall, introduction of bacterial peritoneal infection, depletion of body fluid and electrolytes, discard of plasma proteins contained in ascitic fluid, and even immediate shock if too rapid removal of large quantities allows severe pooling of blood in the dilated splanchnic venous collaterals suddenly released from ascitic pressure.

Indications for abdominal paracentesis include diagnosis, relief of the pain of peritoneal distention, pressure restriction of food intake, relief of dyspnea, preparation for liver biopsy or peritoneoscopy, and protection against further development and external rupture of an established umbilical hernia.

Paracentesis is safest conducted by puncture with a small-size trocar, slow removal of fluid, and limiting withdrawals to not more than 5 or 6 L. on a single day. It is best to avoid scalpel skin incisions of size which would encourage a prolonged leaking peritoneal fistula.

In the presence of extreme hypoalbuminemia, rapid improvement of plasma osmotic pressure with osmotic agents (albumin, dextran, gelatin, polyvinyl pyrrolidone, et cetera) would seem a logically helpful move. However, general experience has been disappointing. Dextran, gelatin, and PVP particles remain so transiently in circulation that these agents are not suitable for long-range objectives. The dextran preparations for intravenous infusion have now been refined so as to avoid most of the early undesirable side effects, but PVP is undesirably deposited for an indefinite period in reticuloendothelial, liver, and kidney cells.

Surgical efforts most tried in ascites of liver disease have been attempts to (1) reduce portal hypertension, and (2) improve drainage of ascitic fluid into the general circulation. Recently, adrenalectomy has been reported successful. (Volwiler, W., Ascites in Liver Disease: Mechanisms and Therapeutic Control: Am. J. Digest, Dis., 3: 103-109, February 1958)

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## Eradication of Tuberculosis

Advances in drug therapy have required changes in public health procedures without discarding the time tested practices of tuberculosis control. Chemotherapy and modern advances in thoracic surgery have resulted in a sharp drop in mortality, declining morbidity, shorter duration of treatment, and diminished hospital confinement. No known single, or combination of drugs destroys all tubercle bacilli in the body and the outlook for improved therapy must depend upon research laboratories. Present antituberculosis drug therapy fails in some cases and has no effect on those infected with drug resistant bacilli. Among others with widespread bilateral disease—especially the elderly—active disease cannot be arrested and such persons must be isolated.

Prior to the advent of streptomycin, therapy depended largely on bed rest, nutrition, and collapse procedures. Treatment was largely in the hands of specialists in pulmonary disease and only a small percentage of patients was under the care of general practitioners. The average physician could not spare the necessary time on a single patient for proper coverage of medical advice and treatment after making a diagnosis of active disease. The case was referred to a sanatorium or to the phthisiologist. Modern drugs have simplified therapy and physicians who never treated tuberculosis under the old regime are now taking care of many ambulatory patients. A result has been that more patients are refusing hospitalization because they or their physician rejects institutional care. The problem now is not only with the "good chronic" with lingering tuberculosis and positive sputum who is allowed to go about his occupation—meantime spreading the disease—but also with early and moderately advanced cases under therapy who form

an added source of infection. Patients without hospital supervision have been arrested, but more have progressed to advanced stages before being sent to institutions. Widespread practice of ambulatory chemotherapy has resulted in development of drug resistant organisms in a number of cases. The unhospitalized tuberculosis patient is a major health problem as a source of infection.

Records for the past half century show a steady drop in mortality rate. In spite of the declining rate, tuberculosis is still responsible for more deaths than all other infectious diseases combined. Once a disease of young adults, the problem now concerns the aged—especially old men. Prior to the advent of antituberculosis drugs, bed rest and collapse therapy helped the rate to fall. Subsequent to that time, campaigns to locate the disease before it was too widespread, and improved medical and surgical treatment resulted in a sharp decline of fatality rate. The first eight years following the use of streptomycin and, later, other antituberculosis drugs demonstrated the most rapid decrease of mortality in history. The drugs have not been controlling the disease in all cases and in some instances the bacilli have been reactivated. Some individuals, kept alive by modern therapy and apparently arrested, have reactivated and died.

The morbidity rate has been declining for several years, but not as rapidly as the death rate. The drop in the annual incidence of tuberculosis would suggest that the number of cases infected is declining. This may lead to an impression with the falling death rate that tuberculosis is becoming a minor problem. In dealing with a disease characterized by chronicity and relapses, an arrested case can flare into activity. Some individuals probably harbor the tubercle bacilli since childhood while others contract it in adult life. The apparently arrested and inactive case can still harbor live tubercle bacilli which can be reactivated. The arrested case with stationary x-ray findings may still have small necrotic lesions that can flare into progressive tuberculosis. The most lucrative source of case finding is still the family contacts of an active or suspicious case. Epidemiological investigation of family contacts results in discovery of more new infections that perpetuate tuberculosis than any other method.

The unknown case is responsible for a substantial amount of infection. This source is far more dangerous than the known cases. Some patients have been diagnosed, but never reported to the public health authorities. A few undiagnosed and untreated cases can start a new epidemic of tuberculosis. Regardless of all case finding methods, many are never located. They have neither been recognized nor diagnosed until just before or after death. Since the advent of chemotherapy, this great hazard has been increasing.

When subjective complaints are absent and there is no clinical finding, the x-ray film is the most powerful instrument in locating minimal lesions. An early diagnosis helps not only in locating the source of infection, but

gives an excellent chance for complete recovery. X-ray film surveys have been conducted annually for a number of years on a voluntary basis. The essence of the survey is to locate the active or suspicious case. Most individuals will have had no contact with an infectious case, but cases without known contact can be located.

The value of a survey can be estimated in: (1) stimulating public interest in tuberculosis; (2) locating cases that have been arrested for many years and have been reactivated; (3) finding inactive cases and following up new contacts; (4) discovering other pulmonary abnormalities (pneumonia, pneumonoconiosis, fungus infections, malignancy, et cetera); (5) noting cardiac enlargements and reporting these to the family physician.

Surveys include only a small percentage of the population, leaving the majority without examination for spreaders of the disease. A negative chest film is no assurance that active progressive disease may not take place in the future.

Present case finding methods are far from satisfactory and repeated surveys have resulted in locating only a small percentage of active cases that were not previously known.

Tuberculosis is far from being controlled in spite of education, research, and modern medical and surgical therapy. Mass x-ray film surveys will not lead to eradication, but may help to diminish the incidence. The tuberculin test should be widely used not only in children, but in controlled groups of adults (school teachers, municipal employees, domestics, food handlers) to locate positive reactors who must be closely supervised. Every open active case must be isolated and treated and all contacts closely followed up by routine x-ray films. Proper isolation of the known patient will prevent the infection from spreading and thus limit the "pool of communicable disease." The major problem consists of the surviving tuberculous individual with unhealed disease who flares into activity. Eradication must depend upon the absence of infection and early diagnosis with rapid treatment to prevent further spread. (Willner, I., The Struggle for Eradication of Tuberculosis: Dis. Chest, XXXIII: 173-178, February 1958)

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## Percutaneous Renal Biopsies

The development of a safe and relatively simple method of doing percutaneous biopsies has provided the physician and the clinical investigator with a new and useful tool for the study of renal diseases. By its use, exact histologic diagnoses can be made which provide a sound background for etiology, diagnosis, treatment, and prognosis. The procedure has also been used to obtain cultures of organisms from infected kidneys; to study, by serial biopsies, the natural history of diseases involving the kidney; to

study reversible disease of the organ; and to assess the effects of drugs on renal and cardiovascular diseases. Renal biopsies have also been used to investigate renal cytology and to study the morphology of the kidney through nephron dissection or by electronmicroscopy.

The indications for doing renal biopsies remain broad. As accurate and effective treatment can follow on exact diagnosis only, the authors are willing to do biopsies in any patient with diffuse renal disease who is able to undergo the procedure without danger and in whom a clear diagnosis has not been established.

With regard to hypertension, it is proper to mention that patients with severe hypertension developed complications more frequently than those with a normal blood pressure. In patients ill with malignant hypertension, the biopsy should be done with great care and only when indications clearly warrant the procedure. Moreover, the authors believe that biopsies should not be done on patients with malignant hypertension until the operator has acquired considerable experience with the technique.

To prevent complications is most important, and careful attention should be paid to the pre- and postbiopsy studies and care which have been explained in detail in previous reviews. The dangers of biopsy include laceration of the kidney or other organs, uncontrollable hemorrhage, and dissemination of infection. To these serious complications, there may be added others, such as renal colic and back pain which disturb the patient. The main problems have been pain and mild to moderate hemorrhagic incidents. Apart from the few who had pain during the biopsy, in most patients signs and symptoms of complications occurred within the first 30 to 60 minutes after the procedure was completed.

With regard to diagnosis, the histologic diagnosis is useful because knowing exactly what is wrong with the patient's kidney provides a more rational approach to therapy and also stimulates the physician to continue to seek the latest therapeutic advances in the treatment of the particular disease he has uncovered. Parrish and Howe found that renal biopsy established the diagnosis in 52% of patients studied when the clinical impression was incorrect; it confirmed the clinical impression in 39% of studies, and in 9%, neither the pathologist nor the clinician could arrive at a definite diagnosis. Renal biopsy has been particularly useful in the diagnosis of unsuspected inflammatory disease of the kidneys, in determining exactly the organism responsible for infection, and in the diagnosis of systemic lupus erythematosus and other diseases of the ground substance and connective tissues (so-called collagen diseases). Renal biopsy is especially of value in the diagnosis of the nephrotic syndrome which has been shown to be associated with a wide variety of pathologic patterns. In many instances of this syndrome, a careful history, a thorough physical examination, and laboratory investigations—including tests of renal function—did not help in making a differential diagnosis. If azotemia was severe and if renal function was

markedly impaired, then one could usually predict that there was severe structural damage to the kidney. The reverse did not hold; there were seen on occasion marked structural changes in the glomeruli with little alteration in renal function and with comparatively normal glomeruli there were found mild, moderate, or severe degrees of azotemia. These are the circumstances which made biopsy so valuable a tool in the exact diagnosis of the nephrotic syndrome.

Renal biopsy is also of value in the treatment of renal disease. Brun has used renal biopsy to select anuric patients for dialysis on the artificial kidney. He found that patients whose glomeruli were severely damaged did poorly, and those with acute lesions responded best. Bjorneboe and his colleagues have used renal biopsy to select patients with the nephrotic syndrome for treatment with corticotropin (ACTH) or steroid hormones. The authors have confirmed these results. The diuretic response to hormone therapy appeared only in patients with minimal histologic evidence of glomerular damage. Renal biopsy also appears to be a more accurate method than culture of the urine in determining exactly the organism responsible for infection within the kidney. (Kark, R. M., et al., An Analysis of Five Hundred Percutaneous Renal Biopsies: Arch. Int. Med., 101: 439-446, February 1958)

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## Diuretic Action of Chlorothiazide

Chlorothiazide, a new diuretic agent recently described by Russo, Baer, Noll and Beyer, has been shown by these investigators to have an action similar to that of the mercurial diuretics in promoting sodium, chloride, and potassium excretion by blocking tubular reabsorption. Although, pharmacologically, it acts in some preparations as a carbonic acid anhydrase inhibitor, it does not have this effect on the kidney in ordinary doses: that is, it does not increase bicarbonate excretion or produce an alkaline urine with systemic acidosis. Chemically, chlorothiazide is a new compound, 6-chloro-7-sulfanyl-1, 2, 4, benzothiadiazine-1, 1-dioxide.

The present report describes a preliminary study with the use of chlorothiazide in therapeutic doses by mouth in the treatment of various types of resistant clinical edema.

Twenty-seven courses of therapy have been given to 13 patients and the diuretic response noted by change in body weight. The clinical diagnoses were: 3, rheumatic heart disease; 3, arteriosclerotic heart disease; 2, hypertensive cardiovascular disease; 1, cor pulmonale and arteriosclerotic heart disease combined; 2, Laennec's cirrhosis; 1, nephrosis; and 1, heart disease of unknown etiology. Most of the cases were in advanced congestive failure, several were resistant to other diuretic agents.

All patients were in the hospital wards on a strict salt-poor regimen and receiving supportive therapy other than diuretics as indicated. A control period in the hospital to establish a base line of unchanging or increasing body weight was carried out in most instances. In several, repeated courses of therapy were given with body weight tending to rise between courses.

Two additional patients with longstanding chronic pulmonary disease and cor pulmonale, in severe pulmonary failure requiring respiratory aid either with the tank or positive pressure respirator, were given courses of chlorothiazide to study the effects on blood gases and electrolytes.

The usual dosage of chlorothiazide was 2 gm. daily given in four divided doses. A few courses were on dosage schedules of 1 gm. and a few at 4 gm. daily.

All were cases of resistant edema, several having become refractory to the mercurial and other diuretics. Although the group is small, the favorable responses in most patients in this series suggest that chlorothiazide is an effective oral diuretic. The only unfavorable side effect, a lowering of serum potassium levels, is an effect inherent in the saluretic action of the drug. Obviously, potassium levels must be watched closely in the clinical use of the drug. Since the writing of this report, the present investigators have been employing chlorothiazide successfully in both hospital and outpatient cases on a weekly schedule of intermittent therapy, 4 days on and 3 days off.

Diuresis occurred in 7 of 10 cardiac patients and in 2 cases of cirrhosis with edema. No unfavorable side effects were noted except for a transient and asymptomatic lowering of serum potassium levels in 5 cases. (Goodkind, M. J., Harvey, R. M., Richards, D. W., Use of Chlorothiazide in the Treatment of Edema: Am. J. Med. Sci., 235: 164-167, February 1958)

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## Hazards of Diagnostic Radiology

In a comprehensive report published in June 1956, a committee of the National Research Council (Great Britain) estimated the levels of exposure to radiation from all sources, including diagnostic and therapeutic x-rays, occupational exposure, and exposure due to nuclear explosions, and sought to assess the hazards resulting from these sources. An unexpected finding was that in the population as a whole the gonadal exposure from diagnostic x-rays probably amounted to no less than 22% of the total normal background radiation and might well be considerably above this figure. It was estimated that the gonadal exposure attributable to fall-out from the testing or nuclear weapons was less than 1% of the background. Hard upon the publication of the M. R. C. report came the communication by Dr. Alice Stewart

and her colleagues which suggested the possibility that leukemia in childhood might result from intrauterine exposure to x-radiation for diagnostic purposes in pregnancy; this added to the disquiet already occasioned by the finding of the M. R. C. report. That the developing foetus is more sensitive to radiation damage than the mature organism seems likely and this may also be true of the early years of infancy.

Meanwhile, it is necessary to retain a sense of proportion when considering the magnitude of these hazards. Professor L. J. Witts, in a recent article in the British Medical Journal, wrote: "The possible 50 cases of leukemia a year from x-radiation in utero must be set against 439 deaths of mothers in childbirth, 15,829 stillbirths, and 9750 deaths in the first week of life in 1955. Obstetricians and radiologists believe that the mortality of mother and child may be significantly reduced by appropriate x-ray examination in pregnancy and that they can save more lives than are likely to be lost from leukemia, appreciating as they now do the hazards of x-radiation.

The leukaemogenic and carcinogenic risks affect only the individuals exposed to the radiation. Of another order is the genetic or racial hazard due to the increase of gene mutations in the population. It is believed that new mutation induced by radiation is probably directly proportional to the additional radiation. Most geneticists agree that the radiation dose which would double the natural mutation rate might have serious ultimate effects on the race. Even if it were assumed for the purpose of argument that all the present mutation rate is due to natural radiation (which is not the case) then the increase due to the cumulative effect of diagnostic radiology would be of the order of 22% of the present rate. In fact, only a proportion of the natural mutation rate is due to radiation (estimated from 2-20% in the M. R. C. report). Accordingly, even at the worst, the maintenance of the use of diagnostic x-rays at current level should not increase the present burden of mutational disease and disability by more than a fraction, although because of the great increase in man-made radiation for all purposes, it is obviously desirable that exposure to radiation should be kept to a minimum.

Attempts have been made to calculate the cumulated dose which would be required over the average reproductive lifetime (say 30 years) to double the mutation rate. The reports of both the Medical Research Council and of the American National Academy of Sciences agree that this dose may lie between 30 and 80 r—that is, an average dose of perhaps 1-3 r per year during the reproductive period. If the contribution of diagnostic radiology in Britain is taken to be 22% of the normal background of approximately 0.1 r per annum, it will be seen that the contribution of diagnostic radiation to the doubling dose is indeed fractional.

In a recent issue of the British Journal of Radiology, 30, 281, there is a leading article on radiation hazards in diagnostic radiology and an announcement of the future publication of a series of articles by radiologists

and physicists of special experience, the purpose of which is to review the literature and to state briefly and clearly the steps which may be taken in any x-ray department to minimize both skin and gonad dosage. In the same issue, are three short articles on this subject. D. K. Bewley, J. W. Laws, and C. J. Myddleton have estimated the dose to various parts of the foetus and to the maternal ovaries during obstetric radiography at from 100 to 120 kVp. They find that the higher kilovoltage techniques result in a substantial reduction in dosage sustained by maternal ovaries and foetus. C. G. Clayton, F. T. Farmer, and C. K. Warrick have also carried out an investigation on the same subject with particular reference to the dosage sustained in the various standard radiographic views. These articles are valuable in that they provide an indication of which views incur the greatest exposure—and in this they are in substantial agreement. The third article is by G. M. Ardran and H. E. Crooks; working at the Medical Division of the A. E. R. E., Harwell, these authors measured the dose of radiation to the gonads from various diagnostic procedures. They found that in many cases, the exposures were lower than those hitherto accepted and they attributed the reduced exposure to special attention to technique—in covering the testes with lead, the use of fast screens for barium work, and the use of filters. Other factors to which they paid attention were the reduction of air scatter and the checking of radiation leaks in tubes and accessories. In the latest issue of the same journal, G. M. Ardran contributes the first of the promised special articles, his subject being dose reduction in diagnostic radiology. W. G. Clarke has recently shown that in chest radiography care is needed to prevent the radiation from reaching areas beyond the chest.

Taken all together, there is no doubt that much can be done by the methods already referred to, and also by the reduction of screening times to the minimum and the use of limiting diaphragms to reduce the exposure from diagnostic radiology. (Hazards of Diagnostic Radiology: Brit. Med. J., 5045: 632-633, September 14, 1957)

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## Trends in Chemotherapy of Cancer

Recent statistics estimate that about 24 million or one of every seven persons in the United States will die of cancer unless new methods of treatment or prevention are found. This article considers some of the recent developments in the field of chemotherapy of cancer.

Today, the chief measures for control of cancer are surgery and radiation therapy. Many cancers can be cured if the diagnosis is made when the disease is confined to the site of origin. With the many improvements in surgical technique and postoperative care, complete removal of a malignancy is safer and more effective. Better radiation therapy has resulted

from advances in high-voltage engineering, nuclear research, and radiobiology. In addition, nuclear research has extended the scope of radiation therapy considerably by providing a number of radioisotopes ($Co^{60}$, $P^{32}$, $Au^{198}$, $I^{131}$). With a combination of techniques, the surgeon and radiologist can cure many cases of cancer. Unfortunately, even with the best of present-day therapy only about one-third of patients with malignancy survive 5 years after the diagnosis is made. This is due in large part to the invasive nature of many cancers which disseminate widely before the primary tumor is discovered.

The hope of finding a selective agent for the treatment of metastatic cancer has long inspired research in the field of chemotherapy. Significant advances have rewarded the research efforts of the past 10 years and today the temporary control of some forms of cancer with chemical agents is a reality.

Many significant advances in chemotherapy of cancer are attributable to improved techniques. In recent years, cooperative groups whose staffs include full-time scientists with special training (cytologists, biochemists, pharmacologists, clinicians) have largely replaced the individual investigator in cancer research. While the latter continues to make important contributions, cancer research is becoming a collaborative endeavor with full-time staffs of scientists and clinicians working toward a common goal.

Many, if not most, of the carcinolytic drugs in clinical use today were discovered through empirical studies—by observing their effect on tumors in animals, their growth-inhibiting effect on cells grown in tissue culture, their effect on bacterial growth, and so forth. After the initial observation indicating growth inhibition, studies must be undertaken to establish the safe maximal dose and the pathologic changes in the tissues before the drug may be tried clinically.

The list of compounds which have a place in treatment of one or another form of disseminated neoplastic disease is a long one and includes such accepted remedies as ACTH, cortisone, estrogens, prednisone, androgens, urethan, triethylene thiophosphoramide (thioTEPA), triethylene phosphoramide (TEPA), triethylene melamine (TEM), nitrogen mustards, Myleran, chlorambucil, Aminopterin, amethopterin, and 6-mercaptopurine. Each of these agents has produced palliation or prolonged remission in some type of cancer. Unfortunately, the cancer sooner or later becomes resistant and it must be admitted that no presently available carcinolytic agent can cure neoplastic disease.

The fact that resistance ultimately develops to all the presently known cancericidal agents has stimulated research workers to discover other and better drugs. Drug resistance itself is the subject of much research employing modern chemical techniques.

Attempts to develop better carcinolytic agents have been materially aided by progress in related fields. Studies of the metabolism of various

types of cancer cells have given important leads which are being vigorously explored. The mechanisms of carcinogenesis are being actively studied by modern biochemical methods and these efforts have uncovered interesting leads. Perhaps the most important developments have come from investigation of the structure and metabolism of the nucleic acids and their relationship to genetics. The various chemotherapeutic cancericidal agents have been classed as follows:

1. Polyfunctional cytotoxic agents
2. Antimetabolites
3. Hormones
4. Antibiotics—bacterial and plant metabolites
5. Oncolytic viruses
6. Miscellaneous substances (urethan, arsenic, antigens, guinea pig serum, et cetera)

Some recent advances under each of these classes are discussed. Numerous clinical and experimental studies indicate that the chemotherapeutic agents can be combined to advantage with surgical or radiation therapy. Under certain conditions, the anticancer drugs themselves may be combined to advantage.

Recent work suggests that certain chemicals may remarkably potentiate the effect of x-rays. The combination of a new chemotherapeutic agent, 6-aminonicotinamide (6AN), an antagonist of nicotinamide, and radiation raised the cure ratio from transplanted cancer of the breast in mice to 86%. Radiation alone cured 27%. Similar results have been obtained with the combination of 6-mercaptopurine and radiation. Bane, Conrad, and Tarnowski recently reviewed the subject of combination therapy. Their article gives many other examples of the synergistic action of chemicals and radiation.

Chemoprophylaxis as an aid to surgery is a recent application of chemotherapy in cancer. It has long been known that despite a thorough operation a cancer may recur in 1 or 2 years with widespread metastases. There has been a growing suspicion that a few cancer cells left at operation disseminate soon afterward to give rise to widespread neoplastic disease. Cole, working on the hypothesis that exfoliated cells at operation could be responsible for dissemination, observed in operations on animals simulating the surgical removal of human tumors that cells escape and bring about recurrence of the cancer. Observations by other surgeons and pathologists point to a substantial spread of cancer cells at operation.

Cole and associates studied the possibility of chemoprophylaxis against this widespread dissemination. They injected 110,000 to 220,000 cancer cells into the portal veins of rats. Half the animals were treated with various dosages of nitrogen mustard, thioTEPA, and other anticancer drugs. The

other animals were untreated. In one series, cancer developed in 7.1, 17.8, and 16.2% of the treated animals, and in 90, 92.1, and 92.3% of the untreated controls. It was necessary to inject the drugs soon after inoculation with cancer cells; drugs given 48 hours after inoculation produced no effect.

Long-term studies were then begun on patients. "Every other patient with cancer of the breast, rectum, colon, or stomach is given prophylactic treatment. These four sites were selected because they are drained by veins as well as lymphatics. The following routine is now used in test patients: (1) All vessels serving the operative site are tied off. (2) At the end of the operation a drug is given intraperitoneally to kill stray cancer cells. (3) On each of 3 days following surgery, the patient is given the drug intravenously." The results of these well controlled studies should be of great interest.

It is apparent that research in the field of cancer chemotherapy, both experimental and clinical, is being better planned and better coordinated. Knowledge of cellular growth and metabolism gained through newer techniques of fundamental biology and biochemistry is being applied in a rational manner to the development of newer drugs. The related and highly important fundamental problems of why cells become malignant and why they develop resistance to the presently available chemotherapeutic agents are under investigation. It seems not impossible that one or another of these approaches may provide the answer to the control of metastatic cancer. (Whitehead, R.W., Trends in Chemotherapy of Cancer: Postgrad. Med., 23: 148-155, February 1958)

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## Boron Hydride (Borane) Intoxication in Man

The plans for producing large quantities of borane compounds as fuels indicate that intoxication with these agents will be a growing hazard. Both the increasing availability of these materials and the paucity of clinical experience with borane poisoning demand that all clinical information be made more available.

Data gained from 83 patients having had a total of 137 exposures are far from complete, but represent a useful body of fact upon which to build. The 8 most severe cases—all hospitalized—are described in some detail.

The most commonly reported symptoms are referred to the particular borane—when it was known. The volatile nature of diborane appears to be responsible for the high frequency of tightness in the chest and cough as earliest evidences of contact. On the other hand, penta- and decaborane first give rise to dizziness, drowsiness, and headache, indicating early effects on the central nervous system. However, all three manifest nervous

system intoxication eventually. Also, respiratory symptoms have been noted in association with the poorly volatilized higher boranes as well as with diborane. It is noteworthy that absorption of boranes — particularly those of higher molecular weight—may also occur through the skin.

Complaints include dizziness, headache, drowsiness, and nausea which appear to be outstanding in frequency except for the respiratory sensations and cough associated with diborane. Evidence for development of central nervous system intoxication includes nervousness, restlessness, fatigue, weakness, shaking convulsions, and perhaps chills and fever. A variety of other signs and symptoms were less frequently noted, but can be expected to occur as the intoxication becomes better known.

In addition to the clinical manifestations of poisoning, the review of available laboratory data indicates strongly that the liver and kidneys have been affected as anticipated from animal studies. A number of abnormal values for liver-function tests were made among patients routinely tested but not hospitalized. This was true also of nonprotein and blood urea nitrogen levels, indicating renal damage or possible tissue destruction. The incidence of these abnormal values in persons without clinical findings is significantly greater than that anticipated in a normal population. These tests then should be useful in screening persons potentially exposed to boranes Methods for the determination of borane in the urine and blood are in the process of development, although values for boron have been reported to have been elevated in the blood in one case. Toxic encephalopathy was described by encephalography in two cases.

Effects that have been described for the cardiovascular systems of severely poisoned animals have, thus far, avoided detection in the clinic. The general pharmacodynamics and possible mechanisms of intoxication in animals are reported. Fortunately, lethal degrees of poisoning carried out in animal studies have not yet been seen in man. Experimental data will provide close guidance in anticipating disease in man. The clinical and laboratory observations reported here suggest that confusion is likely to be commonest between penta- and decaborane intoxication and other causes of uremia, acute hepatic disease, and acute encephalopathies (inflammatory, vascular, and toxic). This would also pertain to diborane in the advanced state, although pulmonary signs might lead one to suspect forms of respiratory disease other than those associated with infection. Milder diborane poisoning should not be too easily confused with the commoner acute respiratory ailments, either infectious or allergic. Also, odor would be of some value as a warning.

It is obvious that proper precautions, detection mechanisms, and protective equipment and clothing may be essential preventive measures. Indoctrination in the handling of boranes should be preliminary to the proper use of equipment. (Lowe, H. J., Freeman, G., Boron Hydride (Borane) Intoxication in Man: Arch. Indust, Health, 16: 531-532, December 1957)

(OccMedDispDiv, BuMed)

## Industrial Diseases of the Chest

With increasing industrial activities all over the world, pulmonary lesions caused by inhaled dusts, fumes, and gases have become steadily more numerous. Several of these pneumopathies are well known, although previously rather rare entities. Larger numbers of industrial workers have lately become involved. Other diseases are new. Among the more recently identified conditions are suberosis, caused by inhaled cork dust; canabosis, occurring in hemp workers; and berylliosis, due to exposures in fluorescent and radio tube and atomic energy industries. Chronic irritation of the respiratory tract mucosa has been observed in the plastic producing industries, textile industries in which bleaching is an important phase, and galvano-plasty industries exploiting chrome and nickel.

Owing to the multiplicity of causative factors and regional differences in industrial practices, the chemical manifestations of the occupational chest diseases are very variable. This has led to considerable conflict of opinion concerning their true significance. One of the problems which has most stubbornly resisted solution is the discrepancy between the radiological features and the clinical findings in the pneumoconioses. It has long been known that advanced x-ray changes indicative of silicosis are compatible with minimal disability. However, it recently has become apparent that dyspnea and asthma may reach great intensity in silicotics before the pulmonary changes are recognizable radiologically. These bronchitic and asthmatic syndromes in silicotics should be differentiated from occuational asthma, such as may be caused by inhaled organic substances which have become specific allergens in individual cases (flour, linseed oil, cotton, hemp, drugs, hair, feathers, fungi, parasites). Asthmatic reactions are also fostered by unfavorable environmental conditions, such as may prevail in the vicinity of furnaces, refrigeration plants, or draughty and humid work areas. The inorganic dusts produce bronchitic and asthmatic states which are associated with anatomical as well as functional changes in the lung. In some instances, the respiratory distress appears to be a delayed result of the pneumoconiotic process and in other instances, it may be a direct and more immediate sequel to the inhalation of hazardous dusts. In up to 80% of silicotics with dyspnea, alterations of the peri-nasal sinuses have been encountered. It is not clear what relationship such sinusitis has to the bronchitis. Clarification is needed of the relationship between infectious, allergic, sinoid, and silicotic bronchitis. Elucidation of the significance of these bronchitides in the genesis of emphysema and pulmonary or bronchial vascular disturbances appears to be a field for further experimental and clinical investigation.

During the past several decades, clinicians have observed material changes in the pattern of pneumoconiotic roentgenographic abnormalities. Part of this is due to the improvement of x-ray techniques. Macroradiography by means of fractional focus tubes has revealed parenchymatous

pulmonary lesions not previously identifiable. However, the major change is real. The pathology of the pneumoconiotic process in miners and sand-blasters has been modified by the rigorous application of prophylactic engineering techniques. Furthermore, the introduction of wet drilling has resulted in the predominance of submicron particles in the working atmosphere with sequential effect on the character of the resulting pneumoconioses. The avoidance of siliceous exposures in coal and iron mines also has placed emphasis on the role of iron or coal dust per se versus the combined effect of anthracotic or ferrous and quartzitic particles. The reduction in the prevalence of tuberculosis in rock workers has further modified the clinical character of pneumoconioses. It has also become apparent recently that the delicate reticular or granular x-ray patterns commonly seen in a variety of benign pneumoconioses are the radiographic equivalents of perivascular and peribronchial deposits of nonfibrosing dusts.

It has long been recognized that pulmonary emphysema is a regular and serious concomitant of advanced silicosis. Its origin has been sought variously as manifestation of compensatory alveolar distension around cicatricial nodular scars and indurated perivascular and peribronchial tissues. The possibility that the emphysema may arise as a result of a bronchostenotic or of a check-valve mechanism at various points along the respiratory passages deserves consideration. Recently, focal emphysema has also been identified as an autonomous dust-induced bronchiolectatic entity. Recognition should be accorded to a neurogenic variety of emphysema which may arise through ganglion cell degeneration as a result of inhalation exposures to toxic substances, such as cadmium. Differential diagnosis between so-called senile emphysema or of idiopathic or constitutional emphysema on the one hand and emphysema of pneumoconiotic origin on the other remains a clinical conundrum, particularly in the elderly industrial workers. A radiologic clue may be found in the dispersed character of nonindustrial emphysema while emphysema sequential to pneumoconiosis tends to have regional dominances.

The relationship between pulmonary tuberculosis and silicosis requires further exploration. Tuberculosis may arise as a cavitary multifocal rapidly fatal complication of preexisting massive silicosis. In other instances, tuberculosis and silicosis are combined from the outset in the same lesions which initially are proliferative in character, but may terminate in massive irregular excavation or in bronchopneumonic dissemination. Silicosis and tuberculosis also may evolve seemingly independently of one another and in some instances the prognosis remains favorable for protracted periods, cavities rarely occurring and tending to be small when present. Nevertheless, the clinical course ultimately tends to be fatal. Survival is shortest in the first group and seldom exceeds 6 months. In the second group, an average period of 14 months may elapse between the commencement of the tuberculous spread and death. The third group may continue in reasonable health for years.

Chemotherapy has had but limited effect on the course of tuberculosis in silicosis. Regression of exudative processes and recently disseminated lesions usually is achieved even by the use of streptomycin alone. Cavities with elastic walls, situated in the less heavily silicotic portions of the lungs may be favorably influenced. Even when the drugs are used in combination or in heroic doses, temporary amelioration is the best that may be expected when the tuberculous process is far advanced in the presence of severe silicosis, or when the cavitary walls are thick and indurated. The chief reason for the failure of these antibiotics lies in the extensive concomitant destruction of the pulmonary vasculature. The drugs remain ineffective because they cannot reach the tubercle bacilli which are imbedded in dominantly ischemic silicotic and tuberculo-silicotic tissues. The impaired circulation is determined not only by morphologic obstructions to blood vessels, but also by angiospasm and the existence of arteriovenous and bronchopulmonary vascular anastomoses. Intravenous drug therapy combined with vasodilators deserves trial in these cases.

Pneumothorax or pneumoperitoneum may achieve temporary closure of tuberculous cavities. Even when such lesions have been sealed off apparently by fibrous tissue, a subsequent common infection may cause the cicatrices to disintegrate with recrudescence of the cavitary disease.

Lung surgery has remained of limited value except when the tuberculous process is strictly localized and the silicotic lesions are minimal. Lobectomies and pneumonectomies have been performed successfully for tuberculous complications when the silicotic process was not yet too far advanced. However, segmental resection appears to have even more restricted indications.

Effective therapy of silicosis itself has not yet been elaborated and the newer medicaments have found no direct application in this disease. In spite of the powerful anti-inflammatory action of ACTH and corticosteroids, the results of their use in silicosis with some exceptions are discouraging. When clinical amelioration is achieved following their administration, it is generally limited to temporary arrest of associated inflammatory processes. In theory, the immature cellular silicotic lesions should be reversible on endocrine therapy, but the disease usually is not recognized clinically until these granulomata have been replaced by fibrous tissue. At this stage, these hormones have no beneficial effect.

The main prophylactic measure against the pneumoconioses remains for the time being engineering control over the sources of noxious dust, fumes, and gas exposures. The physician can also make a contribution by early diagnosis of the main process or its complications, combating bronchospasm to obviate emphysema, controlling secondary infections, and by judicious psychotherapy to eliminate the likelihood of a neurotic complication of the pulmonary disease. (Cancella, L. DeC., et al., Industrial Diseases of the Chest: A Commentary of Current Problems: Dis. Chest, XXXII: 683-686, December 1957) (OccMedDispDiv, BuMed)

## Carbon Monoxide Hazard from Indoor Use of Propane-Fueled Fork Lift Trucks

In recent years, the industrial use of all types of fork lift trucks has greatly increased. Because these trucks are often driven into boxcars, trailers, and confined warehouse areas where ventilation, if any, is poor, a potential carbon monoxide hazard results. For example, carbon monoxide concentrations as high as 400 p. p. m. were measured when a lift truck was used to stack pallets inside a warehouse and 1000 p. p. m. were found during a boxcar unloading. In each of these cases, the trucks used were fueled by gasoline.

Excessive generation of carbon monoxide gas is one of the inherent weaknesses of gasoline as an engine fuel. Carbon monoxide concentrations within industrial buildings can be reduced by using electric fork lift trucks, general ventilation, local exhaust, catalytic units, or by substituting propane for gasoline. While the use of propane as a fuel for fork lift truck engines does not completely eliminate the carbon monoxide hazard, it offers a compromise between gasoline-fueled and electric-powered trucks. A well tuned propane-burning engine should discharge less than 0. 1% of carbon monoxide at the exhaust outlet as compared with 1. 5% in the exhaust gas from a well tuned gasoline-fueled engine and 6 to 7% from an engine not properly tuned.

Fork lift trucks now fueled by gasoline can be readily converted to the use of propane. Experience indicates that when done properly this is a practical and safe procedure. Satisfactory conversion kits are now on the market. Any internal combustion engine is capable of generating dangerous concentrations of carbon monoxide and its use in poorly ventilated areas should be carefully considered. (Hall, D. A., et al., Evaluation of the Carbon Monoxide Hazard from Indoor Use of Propane-Fueled Fork Lift Trucks: Am. Indust. Hyg. A. Quart., 18: 355-359, December 1957)

(OccMedDispDiv, BuMed)

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## Types of Medical Treatment Facilities

U. S. Naval Hospitals - Hospitals under the management control of the Bureau of Medicine and Surgery, Navy Department. These facilities are staffed and equipped to provide relatively complete diagnostic and therapeutic service, together with bed care, nursing, and dietetic service to patients. They may also perform the function of a dispensary. There are 27 U. S. Naval hospitals—23 in the United States, 3 in noncontinental areas, and 1 aboard a hospital ship.

Station Hospitals - These hospitals are among the group formerly termed "infirmaries" and are under management control of the station

command or agencies other than the Bureau of Medicine and Surgery. They are appropriately staffed and equipped to provide diagnostic and therapeutic services, as well as the necessary supporting services required to perform their assigned military medical mission. A station hospital may also discharge the functions of a dispensary.

Dispensaries - Medical-treatment facilities primarily intended to provide outpatient medical service for nonhospital-type ambulatory patients. A dispensary is also intended to perform certain nontherapeutic activities related to the health of the personnel served, such as physical examinations, immunizations, medical administration, and other preventive medical and sanitary measures necessary to support a primary military mission. There are three types of dispensaries:

Selected Dispensaries - For convenience, this title is used to identify those dispensaries having authorized dispensary beds. They are equipped with beds (normally less than 25) for observation of patients awaiting transfer to a hospital and for care of those cases which cannot be treated on an outpatient basis, but which do not require hospitalization. Only under exceptional circumstances are patients retained for longer than 72 hours. These dispensaries are components of medical departments at activities under the management control of bureau or offices other than the Bureau of Medicine and Surgery. Prior to July 1955, these facilities, together with station hospitals, were called "infirmaries."

U.S. Naval Dispensaries - These are established activities with a commanding officer and are under the management control of the Chief, Bureau of Medicine and Surgery. They do not have authorized dispensary beds. There are three such facilities: Washington, D. C., San Francisco, Calif., and Mare Island, Vallejo, Calif.

Other Dispensaries - Such dispensaries do not have authorized dispensary beds and are components of medical departments at activities under the management control of bureaus and offices other than the Bureau of Medicine and Surgery. (StatDiv, BuMed)

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## Biological Research

The Office of Naval Research has funded in fiscal year 1958 the following projects in the fields of Biology.

| Title | Investigator | Universities & Institutions |
|---|---|---|
| Arctic Bibliography | ADM L. O. Colbert | Arctic Institute of North America |

| Title | Investigator | Universities & Institutions |
|---|---|---|
| Behavior and Specificity in Marine Symbioses | Dr. D. Davenport | University of California |
| Mechanisms of Ionic and Osmotic Regulation | Dr. W. J. Gross | University of California |
| Marine Biology of the Mediterranean | Dr. P. Dohrn | Anton and Reinhard Dohrn Foundation (Naples Zoological Station) |
| Studies on Growth of Attached Barnacles | Dr. J. D. Costlow | Duke University |
| Studies of Orientation in Animals | Dr. J. G. Pratt | Duke University |
| Hydrobiological Aspects of Mine Countermeasures Problems | Dr. S. W. Fox | Florida State University |
| Effects of a Series of Environmental Factors on DDT Resistance | Dr. R. R. Sokal | University of Kansas |
| Environmental Factors Influencing Certain Marine Biological Populations in the Woods Hole Area | Dr. P. B. Armstrong | Marine Biological Laboratory |
| Limiting Factors in Mass Culture of Unicellular Algae | Dr. R. W. Krauss | University of Maryland |
| General Biology of Marine Borers | Dr. C. E. Lane | University of Miami |
| Coral Reef Investigations (Equip) | Dr. T. Goreau | New York Zoological Society |
| Biologically Active Steroid Glycosides | Dr. R. F. Nigrelli | New York Zoological Society |

| Title | Investigator | Universities & Institutions |
|---|---|---|
| Bird Navigation | Dr. H. L. Yeagley | Pennsylvania State University |
| Biological Investigation of the Scuba Zone | Dr. W. E. Pequegnat | Pomona College |
| Hydrobiological Studies in the Caribbean (Equip) | Dr. J. Rivero | Univ. of Puerto Rico |
| Synoptic Catalogue of the Mosquitoes of the World | Dr. A. Stone and Dr. K. Knight | Smithsonian Institution |
| Pharmacology and Chemistry of Venomous Fishes | Dr. P. R. Saunders | University of So. California |
| Marine Biology in the Central Western Tropical Pacific (Equip) | Dr. R. R. Harry | Stanford University |
| Tissue Respiration of Fish | Dr. A. W. Martin | University of Washington |
| Studies of Photoperiodic Influence on Animals | Dr. D. S. Farner | State College of Washington |
| Silica Deposition at the Diatom Surface | Dr. J. Lewin | Woods Hole Oceanographic Institution |
| Geographical Distribution of Marine Fouling Organisms | Dr. B. H. Ketchum and Dr. L. W. Hutchins | Woods Hole Oceanographic Institution |
| Underwater Biologic Noise | Dr. W. Schevill | Woods Hole Oceanographic Institution |

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Please forward requests for Change of Address for the News Letter to: Commanding Officer, U. S. Naval Medical School, National Naval Medical Center, Bethesda 14, Md., giving full name, rank, corps, and old and new addresses.

## Radiobiology Course

Announcement has been made by the Armed Forces Special Weapons Project of a course for Medical Corps officers in Radiobiology to be given at Reed College, Portland, Ore., and activities as indicated below. The course will convene in July 1958 and end in May 1959. The tentative schedule for the course is:

| | | |
|---|---|---|
| Part I | Academic Training | Reed College, Portland, Ore. July - December 1958 (24 weeks) including a three-day visit to Arco, Idaho in December |
| Part II | Industrial Health Physics | Hanford Works, Richland, Wash. January - February 1959 (6 weeks) |
| Part III | Special Medical Orientation | a. Nevada Test Site, Nev. February 1959 (4 days)<br>b. Sandia Base, Albuquerque, N. M. March 1959 |
| Part IV | Mass Casualty Course | Walter Reed Army Institute of Research, Washington, D. C. April - May 1959 (6 weeks) |

In view of the increasing importance of atomic medicine in all phases of naval operations, a need exists for medical officers trained in this field. Future assignments offer a wide range of possibilities. The medical officer may serve in nuclear powered vessels, in research or teaching billets, in hospitals, in the field of special weapons effects and at various staff levels.

Requests are desired immediately from Medical Corps officers of the Regular Navy and the Naval Reserve in the ranks of Commander and below who are interested in this field of study. In accordance with BuMed Instruction 1520.7A of 14 December 1956, each request for this course must contain the applicant's agreement to serve for a period of two (2) years after completion of the course, or for two (2) years following completion of any obligated service, whichever is longer. Requests must reach the Bureau of Medicine and Surgery prior to 15 April 1958, and may be made by dispatch if the time element involved requires such action. Dispatch requests must be confirmed by letter. (ProvDiv, BuMed)

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## Short Course in Anesthesiology

The School of Anesthesiology, USAF Hospital, Lackland Air Force Base, Texas, plans to present a special short course in Anesthesiology from 4 to 8 July 1958. This course is designed for officers who have completed two years of residency in anesthesiology, but have not completed three years of required practice.

A limited quota has been obtained for Naval Medical officers. Application should be made to the Chief, Bureau of Medicine and Surgery, via chain of command. (ProfDiv, BuMed)

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## From the Note Book

1. Captain Ruth A. Houghton, Nurse Corps, U. S. Navy has been selected by Secretary of the Navy as the next Director of the Navy Nurse Corps. She will succeed Captain W. Leona Jackson NC USN who is scheduled to retire on April 30 1958 after a four-year term as Director of the Nurse Corps. Captain Houghton entered the Nurse Corps on June 1, 1935 and was appointed Captain on October 17, 1957. She is a member of the American Nurses Association, the National League for Nursing, the Association of Military Surgeons, Sigma Theta Tau, and Pi Gamma Mu. Captain Houghton has completed her work for a Master of Science degree at Catholic University. (NNMC)

2. Captain C. P. Phoebus MC USN, Special Assistant for Medical and Allied Sciences, Office of Naval Research, was the guest speaker at an annual meeting of the U. S. Naval Reserve Company 9-4 at Olathe, Kansas, on 22 February 1958. Captain Phoebus discussed the "Problems of the Space Medicine Man." He also addressed the Rotary Club, a group of Kansas City manufacturers, and the local chapter of the Navy League, Kansas City, Missouri. (TIO, ONR)

3. The Board of Directors of the Navy Mutual Aid Association, on 21 February 1958, announced the election of Admiral Arleigh Burke USN as President. Other officers elected by the membership were Rear Admiral A. H. Van Keuren USN (Ret), First Vice President, Vice Admiral Frank Baldwin SC USN (Ret), Second Vice President, and Lieutenant General R. E. Hogaboom USMC, Third Vice President. Captain Dukeshire, Secretary and Treasurer, reported that 1957 was the finest in the Association's history. During the year, 4769 new members were added to the rolls. Assets increased by over three million dollars to a total of thirty-five and one-half million, while the percentage of income devoted to administrative expenses declined. Captain Dukeshire also noted that the terminal dividend had been

increased to $1,500. The total death benefit now payable to beneficiaries of deceased members is $9,000. Interested officers are advised to contact their local Nonresident Directors or to address their inquiries to the Navy Mutual Aid Association, Navy Department, Washington 25, D. C. (N. M. A. A.)

4. The Department of the Air Force has directed the closing of Parks Air Force Base, Pleasanton, Calif., which includes the 900-bed USAF Hospital located at that installation. This hospital will be disestablished, effective 30 September 1958, and it is anticipated that all patients will be phased out by that date. (USAF)

5. The current controversy over the role of rest and ambulation in relation to liver disease centers about the proper treatment of acute infectious hepatitis. Two comprehensive studies, 1945 and 1955, agreed on the efficacy of a high protein diet, but reported opposite conclusions about the necessity for enforced rest during the acute illness and about the dangers inherent in exercise during the convalescence. A review evaluates both sides of the controversy and suggests judicious use of rest in the treatment of liver disease. (Am. J. Digest. Dis., February 1958; M. A. Payne, M. D.)

6. Every effort must be made to advance the diagnosis and management of early tuberculosis in children. The proper use of the tuberculin test will help do this. A positive tuberculin test is specific and is diagnostic of active tuberculosis in a child if he is very young, if it is preceded by a recent negative test, if it is associated with known contact with an "open" case of tuberculosis, or if it is supported by clinical x-ray or laboratory findings. (Dis. Chest, February 1958; E. M. Jones, M. D., W. L. Howard, M. D.)

7. The course of illness, eradication of streptococci from the throat, and production of antistreptolysin-o were similar in 2 groups of Air Force recruits with Group A streptococcal sore throat treated with either penicillin G or penicillin V. It is concluded that, in the dosages used, penicillin V was not superior to penicillin G. (Am. J. Med. Sci., February 1958; Major N. Schalet USAF (MC), et al.)

8. Colorado tick fever has a specific regional and seasonal incidence and a characteristic clinical pattern. The disease is caused by a virus transmitted to man by the adult hard-shelled woodtick. The incubation period is usually 4 or 5 days. The illness occurs throughout the Rocky Mountain region from early spring to early autumn. (Postgrad. Med., February 1958, R. H. Fitz, G. Meiklejohn)

9. A survey of 617 children receiving routine private pediatric care disclosed that 15.4% of those over 1 year of age had been bitten by a mammal,

2.1% of them more than once. A series of 157 cases of mammalian bites sustained by children over a 20-month period is reported in which investigation of the age and sex incidence of the children and of the seasonal variation and location of the bites was made. (J. Dis. Chil., February 1958; H. A. Carithers, M. D.)

10. Forty-seven patients treated medically for bleeding gastric ulcer were reviewed 4 to 8 years after the bleeding episode. Nine of these patients had refused surgery at the time of initial hospitalization. Hemorrhage recurred in only 3 patients; penetration, perforation, obstruction, or intractability in 6 patients. There were no cases of carcinoma found at follow-up. The over all recurrence rate of all symptoms was 64%. (Arch. Int. Med., February 1958; I. M. Arias, M. D., et al.)

11. During the past 3 years, the authors have replaced 317 segments of the aorta and peripheral arteries with one of six synthetic materials. This report analyzes their experience. (Arch. Surg., February 1958; E. S. Crawford, M. D., M. E. DeBakey, M. D., D. A. Cooley, M. D.)

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## Recent Research Reports

### Naval Medical Research Institute, NNMC, Bethesda, Md.

1. Transport Processes in Electrolyte Solutions, NM 03 02 00.01.01, 7 November 1957.
2. Functional Studies of the Calf Adrenal Cortex Following Total-Body Exposure to a Single Lethal Dose of y-Radiation. NM 01 02 00.02.03, 7 November 1957.
3. The Toxicology of Cellulube 220. V. Human Exposure under Operational Conditions. NM 005 054.01.04, 8 November 1957.
4. A New Tissue Culture Flask with Demountable Bottom. Memorandum Report 57-7 related to NM 52 01 00.02, 19 November 1957.
5. Pharmacological Studies on Irradiated Animals. VI. Protection of Guinea Pigs Against Radiation-Induced Mortality by Cell-Free Mouse Spleen Extract. NM 62 04 00.03.01, 12 December 1957.

### Naval Medical Research Unit No. 3, Cairo, Egypt

1. Needle Biopsy of the Liver and Spleen in Bilharzial Patients. Report II. Experience in 363 Biopsies. Part 2. Histopathological Method of Examination and System of Recording Data. NM 52 02 03.5, August 1957.

### Naval Air Development Center, Johnsville, Pa.

1. Modification of the Thermal Radiation Method for Assessing Antinociceptive

Activity in the Rat. NM 19 01 12.1, Report No. 13, 8 August 1957.
2. Spatial Summation of Pain. NM 19 01 12.1, Report No. 14, 19 September 1957.
3. Some Effects of Prolonged Low Frequency Vibration on the Molecular and Cellular Composition of Blood. NM 11 01 12.12, Report No. 1, 6 November 1957.
4. Discriminative Behavior Following Repeated Exposure to Negative Acceleration. NM 11 01 12.8, Report No. 3, 26 November 1957.
5. G Tolerance in Primates. I. Unconsciousness End Point. NM 11 01 12.9, Report No. 1, 11 December 1957.
6. Change in Plasma Transaminase Activity of Rhesus Monkeys after Exposure to Vibration, Acceleration, Heat, or Hypoxia. NM 11 01 12.7, Report No. 5, 11 December 1957.

Naval Medical Research Laboratory, Submarine Base, New London, Conn.

1. Some Trends in the Submariner Selection Data for 1956-1957. Memorandum Report No. 57-6. NM 23 02 20.1.3, 22 October 1957.
2. The Relation between the Audiogram, Contact Detection, and Sonar Operator Performance. Memorandum Report No. 57-8. NM 22 03 20.3.03, 15 November 1957.
3. Effect of Skin Diving on Respiratory Response to Carbon Dioxide. Memorandum Report No. 57-9. NM 24 02 20.1.01, 27 November 1957.
4. Vision Acuity: The Professional vs. the Non-Professional Examiner. Memorandum Report No. 57-10. NM 23 01 20.03.01, 10 December 1957.

Naval School of Aviation Medicine, Pensacola, Fla.

1. The Perception of Vertical in the Presence of Increased Accelerative Forces. NM 17 01 11, Subtask 1. Report No. 45, 31 October 1957.
2. Validity of Personality Inventories in the Naval Aviation Selection Program. NM 16 01 11, Subtask 1. Report No. 13, 15 November 1957.
3. Depressant Effect of Ether on the Heart - A Study with the Ultra-Low Frequency Force Ballistocardiograph. NM 18 03 11, Subtask 6. Report No. 2, 25 November 1957.
4. The Relation between Manifest Anxiety and Rate of Eyeblink in a Stress Situation. NM 13 01 99, Subtask 1. Report No. 6, 13 December 1957.

Naval Radiological Defense Laboratory, San Francisco, Calif.

1. The Metabolism of Sulfobromophthalein Sodium (BSP) in the Rat. NM 006 015.04, 6 November 1957.

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# DENTAL SECTION

## Dental Corps Training Films

Below is a list of U. S. Navy Dental Corps training films presently available for use on a temporary loan basis. These 16 mm. films may be procured through naval district offices.

Cariology

Process of Human Dental Caries (1943) (Color, sound, 8 min.) MN 2615

Crown and Bridge

Dentistry - Acrylic Bridgework, Part I (1945) (B&W, sound, 15 min.) MN 4352A

Elastic Impression Materials in Crown and Bridge and Inlay Prosthesis (using alginate impression material) (1949) (Color, sound, 25 min.) MN 2050B

Immediate Maxillary Anterior Acrylic Fixed Bridge - Variations (1945) (B&W, sound, 5 min.) MN 4352C

Immediate Maxillary Anterior Acrylic Fixed Bridge Work (1945) (B&W, sound, 19 min.) MN 4352B

Indirect Technique for the Precision Construction of Crowns, Bridges, and Inlays (Prosthetic Series) (1944) (Color, silent, 26 min.) MN 2050

Jacket Crown Construction (1948) (Color, sound, 33 min.) MN 5371

Emergency Dental Treatment

Emergency Dental Treatment (1952) (Color, sound, 20 min.) MN 6723

Endodontia

Root Canal Therapy - Endodontia (1948) (Color, sound, 28 min.) MN 5368

Ocular Prosthesis

Prosthesis - Ocular Replacement (1945) (Color, sound, 17 min.) MN 4391B

Operative Dentistry

The Rubber Dam in Dentistry (1955) (Color, sound, 20 min.) MN 9346

Operative Dentistry (continued)

Operative Dentistry - Preparation of Cavity, Part II (1948) (Color, sound, 10 min.) MN 5369B

Operative Dentistry - Matrix, Part III (1948) (Color, sound, 6 min.) MN 5369C

Operative Dentistry - Amalgam Restoration, Part IV (1948) (Color, sound, 12 min.) MN 5369D

Oral Surgery

Aseptic Procedure in Oral Surgery (1954) (Color, sound, 18 min.) MN 7830

Complicated Exodontia, Introduction (1950) (Color, sound, 19 min.) MN 6722

Skeletal Fixation for Fractures of the Mandible (1943) (Color, sound, 9 min.) MN 1901

Periodontia

Periodontia (1948) (Color, sound, 18 min.) MN 5370

Prosthodontia

Complete Dentures, Alginate Impressions (1950) (Color, sound, 18 min.) MN 6720

Complete Denture - Remote Procedures (1956) (Color, sound, 19 min.) MN 9376

Equilibration of Occlusion (1953) (Color, sound, 20 min.) MN 7340

Factors in the Construction of Full Mandibular and Maxillary Dentures (1943) (Color, sound, 40 min.) MN 2479

Partial Dentures, Biomechanics (1950) (Color, sound, 16 min.) MN 6721

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# RESERVE SECTION

## National Resources Conferences Available to Inactive Reserve Officers

The Industrial College of the Armed Forces will conduct a series of National Resources Conferences of 14 days' duration in the below listed cities on the dates specified. This training, available to the mature intelligent Naval Reserve officer with an outstanding record and whose probable

future war assignment will be at the policy making level, presents all phases of the national economy and the relation of economic factors to political, military, and psychological factors; national and departmental aspects of joint strategic planning and to national policy planning; also peace time and potential war time organizations and the most effective war time controls.

Fort Worth, Texas
beginning 14 April 1958
The 8th, 9th, and 11th Naval Districts and the Chief, Naval Air Reserve Training have been allocated quotas.

Rochester, N. Y.
beginning 14 April 1958
The 3rd, 4th, and 9th Naval Districts and the Chief, Naval Air Reserve Training have been allocated quotas.

Montgomery, Ala.
beginning 12 May 1958
The 5th, 6th, and 8th Naval Districts and the Chief, Naval Air Reserve Training have been allocated quotas.

Bridgeport, Conn.
beginning 12 May 1958
The 1st, 3rd, and 4th Naval Districts and the Chief, Naval Air Reserve Training have been allocated quotas.

Detailed information on these conferences may be obtained by writing to the Commandant, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington 25, D. C. Interested eligible inactive Reserve Medical Department officers desiring to avail themselves of this training should communicate with the Commandant of their Naval District.

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## Class "A" School Training for Hospital Corpsmen

A most comprehensive and progressive type of training for inactive Reserve Hospital Corpsmen is available at Hospital Corps Schools located at the U. S. Naval Hospital, Great Lakes, Ill., and the U. S. Naval Hospital, San Diego, Calif. This Class "A" School Training Program of 12 weeks' duration offers the following curriculum of study:

| Curriculum | Didactic (hours) | Practical (hours) |
|---|---|---|
| Anatomy and Physiology | 70 | 10 |
| Minor Surgery & First Aid | 50 | 50 |
| Preventive Medicine | 40 | 0 |

| Curriculum | Didactic (hours) | Practical (hours) |
|---|---|---|
| Nursing and Dietetics | 70 | 80 |
| Materia Medica & Toxicology | 50 | 0 |
| Military Requirements | 30 | 30 |
| | 310 | 170 |

Total - 480

Classes convene biweekly and trainees may be ordered to report to these activities on any Monday morning. Candidates for this training are limited to personnel in pay grade E-2 and E-3. E-2 personnel must be enlisted under the Reserve Forces Act of 1955 and in pay grade a minimum of six months. The following requirements must be met. The candidate must:

1. Be enrolled in good standing in a pay or nonpay program of the Naval Reserve.
2. Have achieved the minimum Basic Battery Test Score required for admission to a Class "A" School to which ordered. Hospitalmen must have achieved the minimum Basic Battery Test Score (Combined GCT/ARI) of 100. No waivers will be granted for personnel whose scores do not meet the minimum requirements.
3. Have at least three years remaining on present enlistment; or must agree to extend enlistment for the required period.
4. Not have been enrolled in, or completed, a Class "A" School while on active or inactive duty.

No specific quotas are being assigned. Quotas will be controlled by the Chief of Naval Personnel and will be assigned upon request from Commandants. Orders to trainees selected will be for the duration of the course to which ordered.

Hospital Corpsmen who have satisfactorily completed the accelerated Class "A" School Training Program may be examined for, and advanced to, pay grade E-4 when they have completed a minimum of 9 months in pay grade E-3, provided their drill attendance meets the required minimum.

Interested eligible Reservists are encouraged to take advantage of this opportunity for professional improvement and ultimate advancement. (Reference: BuPers Instruction 1571.13; BuMed Instruction 1510.9)

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The printing of this publication was approved by the Director of the Bureau of the Budget, 16 May 1955.

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# PREVENTIVE MEDICINE SECTION

## Reverse Rat Burrows

The majority of rat burrows in U. S. Army camps in Japan are the reverse of what is usual elsewhere. Here, rats dig burrows from the bottom up and reach the surface of the ground at points usually unrelated to shelter or food supply. Such reversed rat burrows are found principally in the dependent-housing areas of these camps. This special problem was first recognized and demonstrated in a few isolated instances, but later was found to be widespread involving more than 50% of the Army dependent-housing areas in Japan.

Rats live in sewer lines in Japan as elsewhere. In an amazing number of instances, breaks in the sewer lines permit the rats to burrow out. Such breaks are most frequently due to improper installation and maintenance of sewer lines, i.e., tiles not completely joined, unsealed angles between tiles and the concrete junction box, use of broken tiles, or unrepaired holes which were made to clear a stoppage, and in some cases, breaks are probably caused by earthquakes.

In parts of the housing areas, the number of rat burrows unrelated to observable food supply is greater than the number of family housing units in the same area. Rats can live only where there is convenient and protected access to a dependable food supply. Few people—including those doing insect and rodent control—are aware that rats living in sewer lines can obtain all needed food from sewage.

Over a period of 4 years, more than 3000 sewer-line breaks were located in Yokohama by tracing rat burrows to them. Of 1620 housing units and adjacent yards, 1168 (72%) had rat burrows connecting with sewer-line breaks. Many sewer-line breaks were not used as exits by rats until customary exits were disturbed or blocked. In one yard, seven sewer-line breaks were revealed by successive rat burrows. Rat infestation of family units is directly related to the number of sewer connected rat burrows in the area.

By tracing new rat burrows, 594 breaks were located and repaired in Yokohama sewer lines during 1957—a 31% reduction over 1956 when 859

such repairs were made. In 1956, there were 409 "complaint call" requests from the dependent-housing areas for rat control; in 1957, there were 278 such requests—a 32% reduction. Nearly every report of rat infestation led to finding additional rat burrows in the yard or beneath the house.

In a housing area (now closed) more than 10% of the family units were continuously serviced for rat control with no net gain or over all reduction in infestation. Rat burrows from sewer-line breaks were numerous and distributed throughout most of the housing area. The continued high rate of rat infestation was due to the concealed thoroughfare between sewer-line breaks and housing units.

Where sewer lines are exceptionally deep, the difficulty of tracing rat burrows to sewer-line breaks is multiplied and tracing may not be practical. Where expected duration of a camp warrants and sewer lines are not too deep, tracing rat burrows to sewer-line breaks and making repairs—as was done principally in Yokohama—is an effective means of reducing the frequency of rat infestation in Japanese Army camp housing units.

This operation—a special kind of rat-proofing—besides making rat control progressively more effective in successive years has likewise made sewer maintenance more effective and has reduced frequency of clogged sewer lines. In rat burrows started from a sewer-line break, all excavated earth goes into the sewer line frequently contributing to clogging of the lines.

In tracing rat burrows from openings at ground surface, it is prudent to take precautions against losing the burrow during excavation. Methods most used to guide the tracing are:

1. A flexible blunt probe consisting of a length of insulated copper wire knotted at one end can be pushed into the burrow to guide excavation.
2. DDT dust applied by a rodenticide fumigant foot pump can be used to mark an entire burrow with contrasting color.

Frequently, more than one burrow reaches the ground surface from a single sewer-line break. Occasionally, burrows from two sewer-line breaks (on opposite sides of the same tile joint) may meet close to the tile and continue to the ground surface as a single burrow. Sometimes a lateral burrow is made which may contain a rat nest.

In the absence of a continuing program of tracing rat burrows to sewer-line breaks and repairing the breaks, rat infestations may be reduced and maintained at a negligible level by a continuing program of baiting in rat burrows with warfarin rodenticide bait torpedoes. In the two housing areas having the greatest frequency of sewer-connected rat burrows, year-round baiting by this method has produced a kill of approximately 100 rats per month in each area, and has resulted in keeping the involved dependent quarters essentially rat-free. (CDR M. S. Johnson MSC USNR, Chief, Insect and Rodent Control Section, HQ, USA, Japan; and Koshino, S., Civilian Supervisor, Insect and Rodent Control, USA, Camp Yokohama, Japan)

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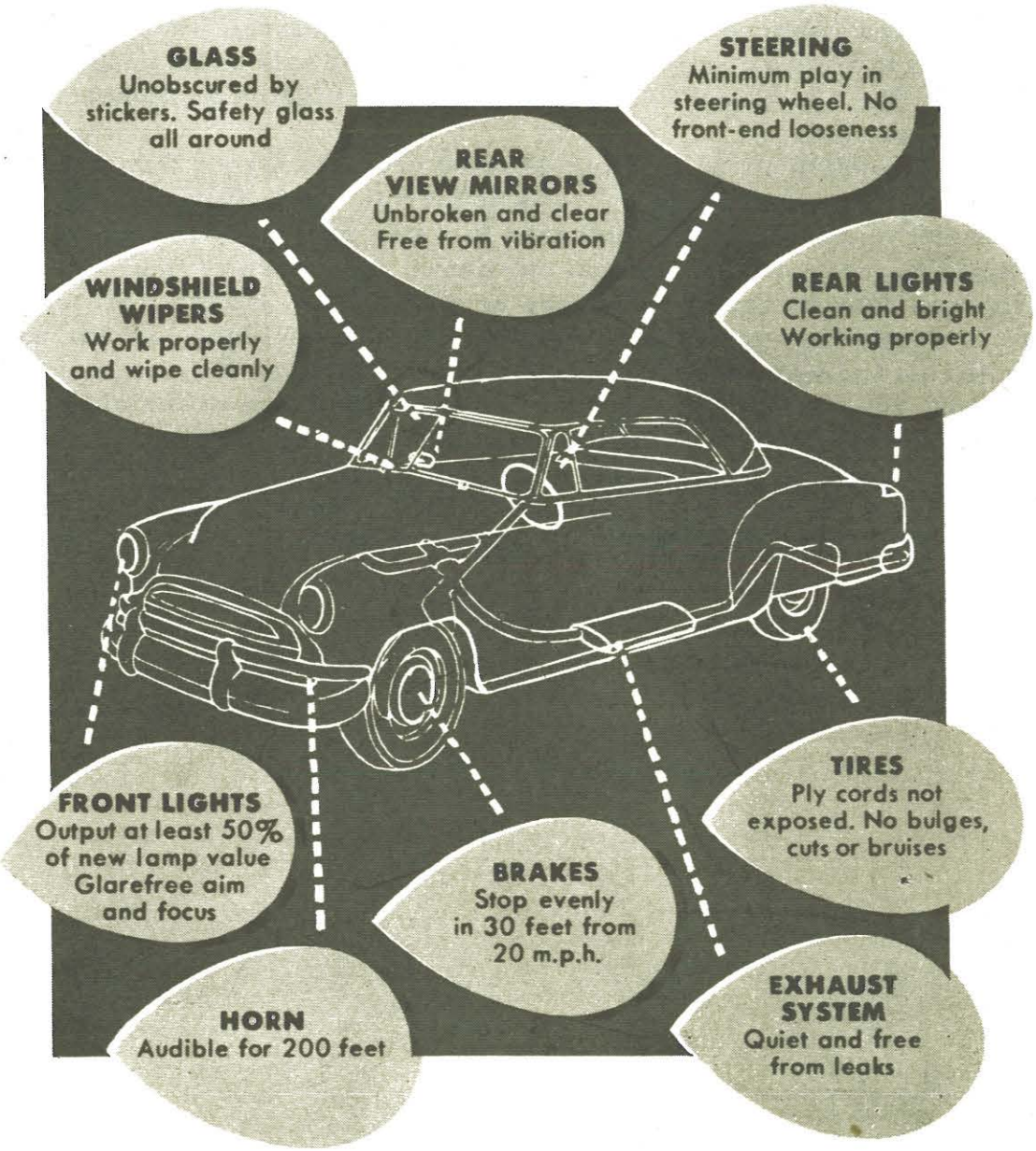
# 10 POINTS IN SAFETY CHECK




**These are the 10 vital points that must be checked in every professional vehicle maintenance inspection. Give them wide publicity. Also remind drivers to supplement the periodic professional inspection with frequent checks of their own.**

☆U. S. GOVERNMENT PRINTING OFFICE : 1958 O - 441841

(Traffic Safety, March 1958)

## Underwater Communications for Scuba Divers

Underwater communications for scuba divers has been of interest for some time. This is a problem being worked on at the Underwater Sound Laboratory and Medical Research Laboratory in New London, Conn., and the Electronics Laboratory, San Diego, Calif. Everyone who has had submarine escape training knows that it is possible to talk to an underwater swimmer. The Electronics Laboratory has investigated audiometric curves underwater.

The threshold curve is from 44 to 60 decibels higher than the threshold in air and the form of the curve is different. The change in the shape of the curve when the ear is immersed in water may be due to changing the resonant frequency of the external ear canal, or it may be that underwater hearing was done by bone conduction, or that the two effects were combined. There is a good case for bone conduction because occluding the ear underwater did not increase the loudness as is the case when the ear is in air. In addition, the elevation of the threshold is of the same order of magnitude as the difference between air and bone conduction and the divers are unable to localize sounds underwater—another characteristic of bone conduction hearing. (P. M. Hamilton, Underwater Hearing Thresholds: J. Acous. Soc. Am., 29: 792-794, July 1957) (SubMedDiv, BuMed)

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